TERRAMODEL NOTE 10

Creating a Design Surface: From Plines

Objective:

The objective of this TM Note is to describe a process to develop a Design Surface using the Design command when starting with Plines.

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TERRAMODEL NOTE 10 – Creating a Design Surface: From Plines

This method creates a Design Surface using the Design command. This process involves starting with a Pline and creating a surface consisting of sets and points. The following steps are needed to use this design method to create a design surface for an emergency spillway.

1. Draw the centerline (using a pline)
2. Offset the centerline.
3. Trim the offset plines.
4. Convert the plines to sets
5. Assign elevations to the sets
6. Draw sets needed to complete the template.
7. Assign slopes to the sets.
8. Use the Design command
9. Troubleshooting errors
10. Use Quick Profile to view a cross section of the design.

This tutorial will use the project file **chapter10.pro**. The POINTS layer has been made invisible so that only the contours and centerline are visible.

1. Draw the centerline (using a pline)

In this example, a centerline has already been drawn as a pline on layer CL. The pline represents the centerline of a dam that has a change in alignment.

The centerline could be drawn from one known survey point to another, or its location could be estimated as in this example. Which method is used depends upon that survey that was taken and the accuracy that is desired.

A plan view of the site showing the centerline and contours is shown in Figure 10-1. The downstream direction is towards the East.

Figure 10-1

2. Offset the centerline

Each slope break of the dam must be shown as a pline for the template to be correct. A cross section of what the final embankment should look like can be seen in Figure 10-2.

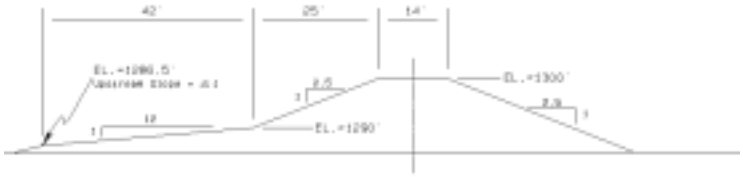

Figure 10-2

First, create a new layer called DAM with object color 13 and point color 13 and make it the active layer.

Offset the centerline 7' downstream

[Edit]-[Offset distance]

With the focus in the Hal window; select the centerline by left-clicking on it

With the focus in the Distance window; **7**

With the focus in the Side window; **Left** (or the user could simply move the cross-hairs to the downstream side of the centerline and left-click)

Note: Left and Right of centerline refer to the direction from centerline when looking towards increasing stations. It does not refer to the direction from centerline while looking at the computer monitor. For this project left of centerline is actually on the right hand side of the screen.

On the command bar; **[Offset]**

Note: If the user typed “Left” in the Side window, the user will have to left-click on the Offset button to create the line. If the user left-clicked in the drawing area downstream of the centerline while the focus was in the Side window, the line will be created automatically.

Note: The command will not be exited completely until the user selects the close button. After creating one line, the focus will be returned to the Distance window and the user can select a new distance and side until all of the lines have been created.

Create the other offsets

Without exiting the command completely, create the lines at 7’ upstream, 32’ upstream, and 74’ upstream of centerline.

Once all of the lines have been created; **[Close]**

The user’s screen should look similar to Figure 10-3 when all of the offsets have been created.

Figure 10-3

3. Trim the offset plines

The plines that were just created will now be trimmed to form the template. The change in alignment must be incorporated into the template, otherwise the top of the embankment will continue on a straight line. The plines will be trimmed close to the change in alignment. The length of the template is not important. One thing to keep in mind, though, is that the template must be entirely above ground. In other words, the template should be "floating" in space and should not intersect the ground surface.

Before trimming the plines, the user must create template boundaries to use while trimming.

Draw a line perpendicular to the centerline.

[Draw]-Pline-[Line]

With the focus in the location window; select a point above and to the right of the alignment change by left-clicking. This will create the first control point of the pline.

With the focus in the location window; right-click anywhere in the drawing area to bring up the Point Snap Modes pop-up menu and select the Perp (Perpendicular to) option.

With the focus in the "Perp. to line segment" window; select the centerline by left-clicking on it.

On the command bar; **[Close]** or **{ESC}** on the keyboard

Figure 10-4 shows what this perpendicular line should look like.

Figure 10-4

Extend that line to the upstream pline

[Edit]-[Extend]

Make sure that the “To bdy” (to boundary) checkbox is enabled so that the user can use the boundary option rather than the distance option.

Note: At this point make sure that the Add pt/seg checkbox is disabled. The user does not want to add new endpoints to the lines.

With the focus in the Boundary window; select the pline that is 74’ upstream of centerline by left-clicking on it

With the focus in the Line window; select the line that is perpendicular to centerline by left-clicking on it. This will extend the line.

On the command bar; **[Close]**

Repeat the last two steps (creating a pline perpendicular to centerline and extending that pline upstream) to create a pline on the other side of the alignment change.

Trim the offset lines at the lines perpendicular to centerline

[Edit]-[Trim]

Make sure the To bdy (to boundary) checkbox is enabled.

With the focus in the Boundary window; select one of the lines perpendicular to centerline by left clicking on it

With the focus in the line window; select one of the offset lines by left-clicking on it.

Note: When the user selects the offset line to be trimmed, be sure to select that line at a location that is “outside” of the template so that the correct portion of the line is trimmed. Selecting the line to be trimmed at a location “inside” of the template (between the two lines perpendicular to centerline) will result in part of the template being erased.

Note: It does not matter which of the radio buttons on the command bar (Add pt or Move pt) is active because these are plines. If these lines were sets, it would make a difference. The user can use **{F1}** while the command is open to learn more about this.

The command will not close until the user manually closes it, so continue selecting the offset lines until all the lines on one side of the template have been trimmed.

Note: Be sure not to trim the centerline.

Once the lines on one side of the template have been trimmed; **[Close]**

Repeat the trim command (using the other perpendicular line as the boundary line) to trim the offset lines on the other side of the template.

The user's screen should now look similar to Figure 10-5.

Figure 10-5

4. Convert the plines to sets

The Design command only works with set lines. The plines must therefore be changed to set lines using the Convert command.

The Convert command creates two points and a set line. Therefore, to prevent duplication of points, erase the plines perpendicular to centerline and only convert the offset lines.

Erase the perpendicular lines

[Edit]-[Delete]

Leaving the select control on Record; select the two lines perpendicular to centerline by left-clicking on them.

On the command bar; **[OK]**

Convert the plines to sets

[Edit]-[Convert]

Leaving the select control on Record; select the four offset lines by left-clicking on them.

In the "To:" portion of the command bar; make sure the Set radio button is active (and not the pline button)

Enable the Del old check box. This will delete the plines after the sets have been created to replace them.

Note: Enabling the Lay check box will cause the sets to be put on the current layer. If the Lay check box is disabled, the sets will be placed on the same layer as the original plines. For this project, the plines are on layer DAM, and the active layer should still be DAM , so it doesn't matter of the check box is enabled or not.

On the command bar; **[OK]**

5. Assign elevations to the sets

Each set line (as well as the points on the set line) must be given the appropriate elevation.

[Modify]-Elevation-[Elevation]

With the focus in the select control (Objs) window; right-click anywhere in the drawing area and choose the OfLine option from the select control pop-up menu.

Leaving the focus in the select control window; select the sets that are 7' upstream and 7' downstream of centerline by left-clicking on them.

With the focus in the Elevation window; **1300**

In the command bar; make sure the left radio button is active. This tells the program that the elevation that was entered is an absolute elevation. If the right radio button was the active button, the program sees the elevation that was entered as a relative elevation and adds that to the original elevation of the points.

On the command bar; **[OK]**

Use the same procedure to assign elevations to the sets and points that are 32' upstream (EL = 1290) and 74' upstream (EL = 1286.5) of centerline.

6. Draw the sets needed to complete the template

Set lines need to be created that connect the ends of the offset lines.

[Draw]-Set-[Set]

Left-click on the end point of the line that is 7’ downstream of centerline

Left-click on the end point of the line that is 7’ upstream of centerline

Left-click on the end point of the line that is 32’ upstream of centerline

Left-click on the end point of the line that is 74’ upstream of centerline

On the command bar; **[Close]**

Repeat this procedure to connect the end points on the other side of the template.

The user’s template should look similar to the one in Figure 10-6

Figure 10-6

7. Assign slopes to the sets

Assign slopes to the lines perpendicular to the centerline

[Edit]-[Edit objects]

With the object in the focus window; select one of the lines perpendicular to the ctnerline

Choose slopes from the list box on the command bar

In the cut window; **0%**

In the fill window; **0%**

On the command bar; **[OK]** (the cut and fill slopes will then be displayed in the message scroll)

On the command bar; **[Close]**

Select the other set line perpendicular to the centerline

In the cut window; **0%**

In the fill window; **0%**

On the command bar; **[OK]** (the cut and fill slopes will then be displayed in the message scroll)

On the command bar; **[Close]**

On the command bar; **[Close]** This will exit the user completely out of the command.

Note: Notice that it took less time to do the second line because the command was not completely exited after the first line, and the program defaulted to the slopes option when the user chose the second line. TERRAMODEL will default to the option that was last used when running the Edit Object command. Also note that the user could have continued on and assigned slopes to the offset lines without ever completely exiting the Edit Object command.

Assign slopes to the lines parallel to the centerline

Note: Slopes only need to be assigned to sets that define the outside of the template (7' downstream and 74' upstream). The slopes for the inside sets are defined by their location and elevation.

[Edit]-[Edit object]

With the focus in the object window; select the set that is 7' downstream of centerline

The program should default to the slopes option because it was the last option used. If it did not default to the slopes option, choose the slopes option from the list box.

In the cut window; **1** (This template is located in fill, so the cut slope is irrelevant)

In the fill window; **-2.5** (Fill slopes must be entered as negative numbers)

On the command bar; **[OK]**

On the command bar; **[Close]**

Select the line that is 74' upstream of the centerline

In the cut window; **1**

In the fill window; **-4**

On the command bar; **[OK]**

On the command bar; **[Close]**

On the command bar; **[Close]** This will exit the user completely out of the command.

8. Use the Design command

[DTM]-[Design]

Select the POINTS layer as the original DTM surface and DAM as the design DTM surface.

On the command bar; **[OK]**

The embankment design can be seen in Figure 10-7

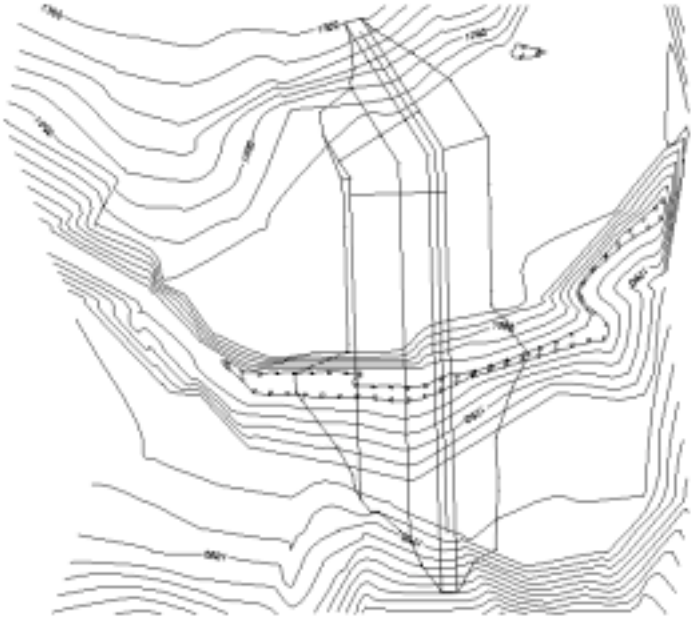

Figure 10-7

9. Design Troubleshooting

Note: This section was taken nearly word for word from the TM Notes that were written for the DOS version of TERRAMODEL. The author has not worked with the design command enough to give any solid advice on troubleshooting a design error. Since this section was taken from the old TM Notes, there may be information that is not applicable to the Windows version of TERRAMODEL.

If the design surface is wrong or the Design command did not work, one or more problems may exist. Often times, the problem is not clear, and the solution is found by trial and error. Save the project first and then experiment in it. The user can always reload the saved file.

Common problems or error messages encountered are:

1. Duplicate points (same northing ,easting, and elevation).
2. Design surface extends beyond the original DTM surface.
3. 3D points outside of the design surface
4. Design surfaces that "flip over" or extrapolate in the wrong direction.

Some suggestions to try when troubleshooting are:

1. To test if the set slope entered will zero out properly on the original DTM surface, try using the DTM shot command (under the DTM menu).

2. To erase an erroneous design surface, use the Delete command, select Ofline from the select control menu, then select the perimeter line of the design surface. The Ofline option selects lines and points.

3. List the points, sets, and objects of the design layer. Look for duplicate points or lines.

4. Splitting up a set line when the design "flips" or goes the wrong direction by adding more points along the line. After adding the points, erase the original set line and then draw new set lines between the points (the slopes will have to be reassigned also). Be careful when assigning elevations to these points if the original set line is on a slope.

10. Use Quick Profile to view a cross section of the design

The Quick profile command uses all visible layers, so the POINTS layer must be made visible.

Use the Quick profile command,

[DTM]-[Quick profile]

With the focus in the From window; select a location on the upstream side of the dam.

With the focus in the To window; select a location on the downstream side of the dam.

The Quick profile window will appear containing the profile. This can be seen in Figure 10-8. Notice that the user can change the vertical exaggeration and/or zoom in on selected areas of the profile.

To close the Quick profile window; **[Done]**

The user can now create another Quick profile, or **[Cancel]** to exit the command.

The user may want to take Quick profiles at many locations perpendicular to the centerline as well as parallel to the centerline to make sure the design surface is correct.

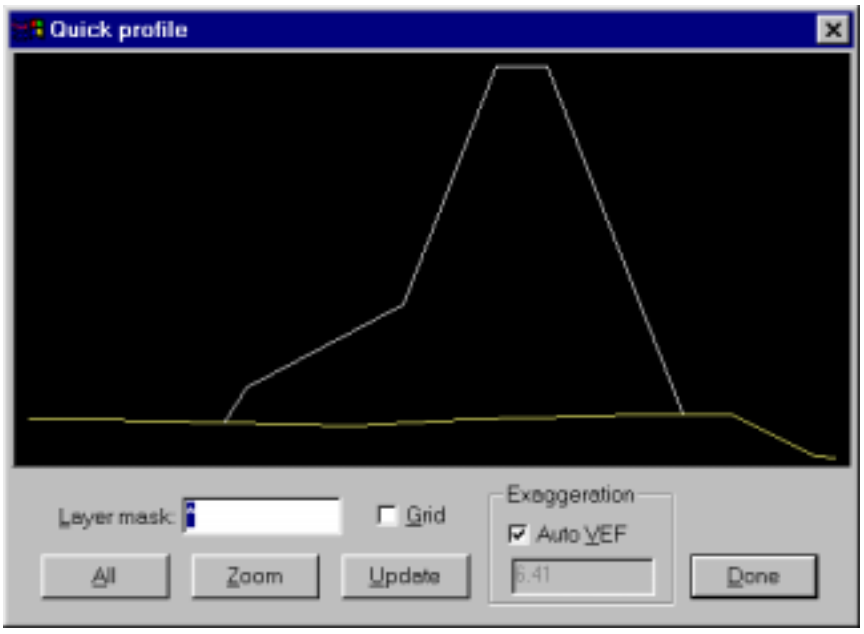

Figure 10-8